BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/336,525	06/18/1999	JUDY HUANG	AMAT/3577.X1/PD	7748

32588 7590 11/05/2002

APPLIED MATERIALS, INC.
2881 SCOTT BLVD. M/S 2061
SANTA CLARA, CA 95050

EXAMINER	
PADGETT, MARIANNE L	

ART UNIT	PAPER NUMBER
1762	

DATE MAILED: 11/05/2002

15

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.	Applicant(s)
09/836,525	Jiuly Huang
Examiner	**Group Art Unit**
M.L. Padgett	1762

—The MAILING DATE of this communication appears on th cover sheet beneath the correspondence address—

P riod for R ply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

☒ Responsive to communication(s) filed on 6/24/02 & 7/31/02.

☒ This action is **FINAL.**

☐ Sinc this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 1 1; 453 O.G. 213.

Di positi n of Claims

☒ Claim(s) 24-26, 28, 30-38, 40, 42-49 is/are pending in the application.

Of the above claim(s) _____ is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) 24-26, 28, 30-38, 40 & 42-49 is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claim(s) _____ are subject to restriction or election requirement

Application Papers

☐ Th proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner

☐ Th specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119 (a)-(d)

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119 (a)-(d).

☐ All ☐ Some* ☐ None of the:

☐ Certified copies of the priority documents have been received.

☐ Certified copies of the priority documents have been received in Application No. _____.

☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a))

*Certified copies not received: _____.

Attachm nt(s)

☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). 14

☐ Interview Summary, PTO-413

☐ Notice of Reference(s) Cited, PTO-892

☐ Notice of Informal Patent Application, PTO-152

☐ Notice of Draftsperson's Patent Drawing R view, PTO-948

☐ Other _____

Office Action Summary

1. It is noted that applicants have eliminated the last of the 112 paragraph 6 (step for) language from the claims, specifically from claim 34, so that the requested interpretation under that statute is no longer in effect. It should be noted that this broadens the meaning of this claim, so that the depositing step is no longer limited to processes as specifically described in the specification, but the first layer, now limited to SiCOH (no stoichiometry necessitated) and SiC may be deposited by any technique. This change however removes the uncertainty posed by the paragraph 6 interpretation, thus removing the 112 paragraph 2 rejection.

2. Claims 31-33 and 46-49 are objected to or rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 33 is objected to for amending the claim to read "a plasma" in line 2, instead of "the plasma" which showed proper antecedent basis, since the independent claim already introduced this limitation, and the claim still ultimately depends therefrom. Also see new claim 49 for an analogous problem in line 2.

In claims 31-32, applicant has also changed the language form that where the antecedence is clear, to "the same processing chamber" which has no proper antecedent basis, hence is also objected to.

In new claim 46, "improved" is generally considered a relative term, since depending on the individuals desire, an improvement may either increase or decrease a quality or property, however the most logical implication would be that of increasing adhesion and oxidation resistance, since that what most people generally desire.

3. Claim 45 is rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Applicant's amendment has removed claim 33 from this rejection, but the same issues still remain in claim 45. There is no evidence or suggestion in the specification, that inert gas, plasma treatment of organic polymers or α-C, or "αFC", or "SiCOH", or "SiCO:H", will have no composition changes caused by the plasma treatments. Figure 2, data line A, described on page 6 provides support for these claims, only for SiC layers. A case could be made for amorphous carbon (αC) with absolutely on impurities, having no change in chemical composition, but applicants' specification provides no evidence for a like extrapolation to other claimed compounds, whose chemistry would not be the same (or is totally is unknown as claimed), hence can not be said to be homologous. Applicant's citation of p. 5, line 21-24 provides absolutely NO support for or evidence of no compositional changes.

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 46-47 and 49 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Nguyen et al ('935), as described below.

6. Claims 24, 26, 27, 30, 31, 34, 36, 38, 42, 45-47 and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nguyen et al ('935), in view of Itoh et al (German patent).

Nguyen et al's technical field is for processing integrated substrates, including semiconductors (col. 1, lines 9-17), teaching a silicon substrate with a first layer being Si-containing, while applicants have limited their claim to depositing the first layer on a semiconductor substrate, so the subject matter is analogous. Part of Nguyen et al's process is coating all of the chamber with polymeric fluorocarbon, where these films exhibit predominately C-CF_x binding with a F/C ratio of about 1:1 to about 3:1 (col. 6, lines 44-53 and claims 10 and 16). These same deposits are also applied to the composite substrate. Nguyen et al does not discuss whether or not the polymers are amorphous in structure, but such is a typical morphology for plasma polymerized deposits, hence maybe considered inherent, or alternately obvious due to their taught highly crosslinked and dense form. As applicants have stated that "FC" is not a chemical formula, but indicated elements of the deposit, the range of F/C ratios taught by Nguyen et al reads on such deposits. It also reads on the option of organic polymeric material. For deposition on the chamber, the initial coating phase, see col. 3, lines 31 - col. 4, line 4.

After precoating the chambers, electrodes and walls, the substrates are placed in the chamber and treated with a plasma of Ar, or alternately another inert gas, such as He (col. 2, lines 58 – col. 3, line 9; and col. 4, lines 5-33). Then continuing processing in the same chamber, another fluorocarbon film is plasma deposited, that will form on both the substrate and the chamber surfaces that were precoated (col. 4, lines 34 – col. 6, lines 53; and Examples).

Particularly note the teaching that the positive ion bombardment that takes place, creates films with high density that tend to resist taking up oxygen form air (col. 6, lines 28-30). In Nguyen et al, see the abstract; col. 1, lines 9-17; col. 2, lines 22-45 and col. 3, lines 18-47 for plasma deposition (i.e., plasma treatment) on a substrate that may be silicon, contain Si, and/or have thereon a initially applied coating that may be silicon containing, including silicon oxides or Si nitride (col. 2, lines 58-62 and Ex. 1 on col. 6-7), where the substrate was *in situ* plasma cleaned (also discussed above). Note Ex. 1, where the Si substrate with a Si_3N_4 layer is Ar-plasma treated, than C_xF_y is deposit thereon. Gases, such as C_2F_4, etc., may be input at a rate of about 20-150 sccm, with initial RF power densities being about 0.02 to 0.05 W/cm^2, with pressures during the initial plasma deposition of about 200 mtorr. While Nguyen et al's silicon containing multilayer substrates are generically inclusive of SiC or SiCOH containing layers on Si (i.e. semiconductor) substrates, as claimed by applicant, their specific examples differ by not including these compounds/materials as the top or first layer on their Si-containing compound substrate.

The German patent to Itoh et al (see the translation: on page 2; page 3, lines 1-8; page 5, 5-6th paragraphs; page 7, bottom; page 9, esp. last full paragraph; page 10, etc) teaches semiconductor devices having various layers, inclusive of an intermediate insulation layer containing Si, O, C and H, where the amount of C is not less than that of Si, via a CVD process, possibility a plasma process. This intermediate layer has formed on it another insulating film that is from a different material. Given these teachings, it would have been obvious to one of ordinary skill in the art, that the silicon containing layer on a Si substrate, that is Ar-plasma treated, than deposited with a fluorocarbon insulting layer in Nguyen et al, could have been

effectively supplied by the intermediate layer materials of Itoh et al, because they fit all the necessary criteria of Nguyen et al, thus are consistent or suggested by the taught generic category; is a Si oxide derivative, hence analogous to the exemplary silicon oxide; and is desired to be used with a different insulative layer deposited on it, thus for like purposes.

In Nguyen et all, the parameters for the inert gas plasma cleaning process include RF power of 100-1000 watts, gas flow (Ar) of about 20-150 sccm, pressures of about 10-1000 mtorr (.01-.1 torr) and a self bias of about - 400 to - 700 volts. While the flow rates overlap with applicant's claimed range, the pressure ranges just miss overlapping at about .1 torr and about 1 torr, this is not a significant amount, thus an obvious variation and consistent with "about" which means that values not significantly different are also included in the claimed range. Power and power density are not measuring the same quantities, hence power usage can not be directly compared by the PTO with the information given, however it would have been obvious to one of ordinary skill in the art to determine power/power density relationships, and optimize them for particular reactor configurations, variations in gas pressure, etc., as well as for the particular material being treated, plus desired effect of cleaning, but not reacting, thus like ranges of optimization for variations in apparatus, etc., would have been expected.

7. Claims 24, 26, 33-34, 36, 38 45-47 and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mori.

In Mori, see the abstract, col. 1, lines 5-25^{+}; col. 4, lines 1-27 and 56-68; col. 5, lines 23-38; col. 6, lines 43-53; col. 11, lines 9-29; col. 12, lines 33-52; etc., for a process where the substrate maybe a Si wafer, and where a coating of an organic polymer, or a SOG (spin-on-glass layer of Si oxide that may contain hydrocarbon residues, therefore is composed of Si, C, O and H

as claimed, is treated with a plasma. Since applicant's SiCOH is not a chemical formula, the proportions of elements present can be any amount, including impurities. Note, as seen on col. 11, lines 9-29 that the plasma may initially be only made from helium, hence reading on applicant's exposing step, which requires essentially inert gas in the plasma. Since the overall process claimed may comprise any other number of steps besides those listed, it does not mater that the He plasma is followed by reactive gas plasma, exemplified by CF_4 + He, as use of additional steps/plasma treatments, such as the following reactive plasma, is included by the broad (comprising) claim language, as long as at some time only inert gas plasma is used. Note that neither the He plasma, nor the reactive plasma used in removing edge beads, etc., changes the composition of the remaining polymer or SOG layer. Mori's process is implicitly for treating a layer in a semiconductor device that will be multilayered, hence the presence of semiconductor in the substrate which has been coated is considered given. Mori does not explicitly follow the plasma treatment steps with another coating, however it would have been obvious to one of ordinary skill that any of the dielectric or masking layers discussed by Mori are only one of a series of layers that would have been expected to be followed by subsequent layers, in all cases except the final capping layer. Any such subsequent layer reads on the claimed generic deposit of the second layer for the claims as written.

8. Claims 24-26, 28, 30-38, 40 and 42-49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nguyen et al ('935) as discussed above in section 6, in view of Tanabe et al.

As noted above, Nguyen et al teach generic silicon containing coating on their composite substrates, where the substrate itself maybe Si, but not specifically SiC containing compositions for use in semiconductor processing, however Tanabe et al (Abstract; col. 1, lines 5-18; col. 7,

lines 30-36; col. 8, lines 56-65 and col. 10, lines 43 col. 11, lines 20^{+}; and col. 12, lines 12-20) show that use of SiC as an intermediate on semiconductor substrates, such as Si, prior to the deposition of a carboneaous layer of diamond, is a known and desired combination of layers. The SiC maybe deposited by various possible plasma CVD techniques, is shown to have been known in the semiconductor art, with notice taken that diamond related deposits, unless doped, are generally electrically insulating, hence it would have been obvious from teachings of Tanabe et al to use material, such as SiC, as a Si-containing intermediate on Si substrates in the process of Nguyen et al for reasons analogous to those applied in section 6 for alternative specific Si-containing layers, and because Tanabe et al shows SiC to be desirable for adhesion of subsequent carbon based coating, hence expected to be effective.

It is further noted that all processes in this combination are plasma processes, with Ar plasma treatment and the CF-containing deposit specifically being done in the same chamber. There is no specific teaching of the first layer (Si-containing) and the exposing being done in the same chamber, however when all processes required are consistent with one plasma apparatus' capabilities, it would have been obvious to one of ordinary skill in the art, that all those plasma process could have been preformed in the same chamber depending on production line efficiencies and economics of scale, especially as exposing and deposition have already been shown to be preformed in one chamber.

9. Also, of interest were Batha et al with further plasma CVD of SiC techniques and Goel et al and Koike et al, who both teach use of SiC as an underlayer before DLC deposits, with teaching of inert gas plasmas cleaning before the claimed coating, but are not discussing

semiconductor substrates, however would be cumulative to Tanabe et al above for further motivating inert gas plasma used in the above combination, where SiC is specifically involved.

Malaczynski et al, previously applied remains of interest, but use conducting substrates (Al-Si alloy), not semiconducting ones in a process, that is otherwise as claimed.

10. Applicant's arguments filed 6/24/02 and discussed above have been fully considered by they are not persuasive.

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

12. Any inquiry concerning this communication should be directed to M L. Padgett at telephone number 703-308-2336 on Monday-Friday from about 8:00 am – 4:30 pm, and Fax # (703) 872-9311 (after final official) or 305-6078 (unofficial).

M. L. Padgett/mn Oct. 21, 2002 & Nov. 5, 2002

MARIANNE PADGETT
PRIMARY EXAMINER